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Comparison of Business Model Development Frameworks with regard to IoT

Martin Kinitzki[1], Dieter Hertweck[2]

Abstract: With the Internet of Things being one of the most discussed trends in the computer world lately, many organizations find themselves struggling with the great paradigm shift and thus the implementation of IoT on a strategic level. The Ignite methodology as a part of the Enterprise-IoT project promises to support organizations with these strategic issues as it combines best practices with expert knowledge from diverse industries helping to create a better understanding of how to transform into an IoT driven business. A framework that is introduced within the context of IoT business model development is the Bosch IoT Business Model Builder. In this study the provided framework is compared to the Osterwalder Business Model Canvas and the St. Gallen Business Model Navigator, the most commonly used and referenced frameworks according to a quantitative literature analysis.

Keywords: Internet of things, IoT, business model, value proposition

1 Introduction

The Internet of Things (IoT) trend is sprouting up just as the amount of use cases arising from it. As the probably most discussed trend in the computer world lately, most consider the Internet of Things the next web revolution. With all the new chances promised to companies, ignoring it might put organizations at risk of falling behind the competition [GaFC13]. When it comes to the implementation of IoT into business strategy, many companies struggle as it entails a great paradigm shift. The Ignite methodology promises to help with these strategic issues as it unites best practices from diverse industries with expert knowledge and derives recommendations for the top level.

The objective of this study is to introduce the strategy execution part of Ignite and answer the research question on how the framework for IoT business model development compares to established frameworks with a matrix of criteria as the result. For this purpose, it refers to the most recent literature as well as the most commonly used and referenced frameworks. Due to the fact of the project being a work in progress, there will only be a short overview given of the methodology and the discussed frameworks. The focus is put on the areas of IoT Strategy, IoT Opportunity Identification and Management and the IoT Business Model Development.

[1] Reutlingen University, Faculty Informatics, Alteburgstr. 150, 72762 Reutlingen, martin.kinitzki@reutlingen-university.de.
[2] Reutlingen University, Faculty Informatics, Alteburgstr. 150, 72762 Reutlingen, dieter.hertweck@reutlingen-university.de.

2 Methodology

In order to focus on answering the research question, a systematic literature analysis was conducted. The underlying method was adapted from Webster und Watson [2002]. Relevant literature was captured from (a) ACM; (b) IEEE and (c) SpringerLink. The search strings used in combinations are presented in Table 1.

In order to set the focus on the latest findings, we only considered literature published since 2012. Whenever possible, a filter criteria restricting results to scientific papers and disciplines related to management or computer science was applied.

Search keyword
'internet' ∧ 'things'
'ubiquitous' ∧ 'computing'
'business' ∧ 'model' ∧ ('canvas' ∨ 'development' ∨ 'framework')
'idea' ∧ 'generation'
'business' ∧ 'opportunity' ∧ identification

Tab. 3: Search strings for the database research

After removing duplicates and narrowing down the results, the contents were pre-examined in a first content-related evaluation based on titles and abstracts. As a last step in the process the cross references were checked and appropriate results were added to the reference library. Finally, the remaining literature was analyzed in full detail in order to answer the raised research question. For individual results on each search execution and keyword combination per database there is a table to be found in the appendix of this paper.

3 Theoretical Foundation

3.1 Ignite project

Although the term of the Internet of Things is broadly used, there is no common definition [WoFl15]. It mostly depends on the perspective from which it is viewed – whether the connected things themselves, the protocols or the semantic challenges are put into focus [WoFl15]. The definition of the Internet of Things used in this term paper is more abstract and describes the vision of the physical and digital worlds becoming one as a result of smart objects being connected through the Internet [CoEk11, FlWW15]. The idea goes back to the early 90s with Weiser visioning the Ubiquitous Computing [Weis93] and has been developed further over the years with the term of Pervasive Computing [ECPS02, Saty01] as the precursor to the Internet of Things.

Ignite represents a methodology based on best practices from the Enterprise IoT project driven by Robert Bosch GmbH. Enterprise IoT holds a set of analyzed use cases from

various industries in cooperation with certain branch-specific experts with the goal to develop IoT best practices and make them available as an open framework. It is supposed to support the management of the transition towards IoT-based business models. Hereby the strategy definition and management at enterprise level as well as the solution delivery and implementation at project level are covered. Ignite consists of two areas dealing with the following aspects [Ente15a]: a) Strategy Execution: Definition and management of an IoT strategy and portfolio as well as the preparation for IoT adoption and b) Solution Delivery: Planning and execution of IoT projects.

3.2 Examined Ignite modules

Entering the Internet of Things, every company is forced to ask itself how far to go when the entailed paradigm shift is concerned. The Ignite Strategy Execution is supposed to help answering this question by creating a better understanding of how the transformation into an IoT driven business should look like and how a portfolio of IoT opportunities has to be managed before finally being executed with the result of new business models [Ente15b]. The strategy execution part of Ignite is divided into six areas, shortly described in the following.

IoT Strategy: The IoT strategy, just like any business strategy, contains a vision as well as goals and guiding principles. Is also describes strategic alliances and partner ecosystems that should be developed. The portfolio management of IoT opportunities and projects just as budget management are part of the IoT strategy, too.

IoT Opportunity Identification and Management: The IoT Opportunity Identification covers the generation of innovative ideas within the organization from which new business models are derived later in the process. Idea refinement as well as the development of the final business model is covered in IoT Opportunity Management. Detailed business models based on the most promising ideas are created and their feasibility is analyzed.

Initiation: The initiation stage describes the phase of chosen opportunities becoming initiatives, ran as internal projects, spin-offs or even merger and acquisition projects. Internal projects interface with the IoT-Ignite Solution Delivery methodology.

IoT Center of Excellence: The goal of an IoT Center of Excellence is to accelerate new projects by providing consulting and support with the knowledge based on projects from the past.

IoT Platform: The IoT Platform represents a platform on which IoT projects are developed. It usually is shared and includes connectivity solutions as well as technical and functional standards.

The development of these elements to full extent should not be regarded an obligation for every organization. It rather depends on several factors like whether it is executed by

a start-up company at early stage or how well established the strategy and portfolio management already are. In any case it will be necessary to examine the current state of structures and processes in order to identify the need for adaptation [Ente15b].

3.3 IoT Strategy

When defining an IoT Strategy, an organization has to decide how far it wants to move towards the Internet of Things trend. The answer to this question will most likely vary depending on factors like industry, grade of diversification or the force of competition [Ente15c]. According to the best practices the methodology is derived from, it is inevitable to explicitly articulate vision, goals and guiding principles based on these questions and their answers before developing IoT business models [Ente15c]. The following examples are based on the IoT Strategy Execution as described in Ignite.

Vision: Company X will transform itself from a pure product business into a market leading provider of connected industrial services.

Goals: In the product areas P, Q, and R, we will reduce maintenance costs by X % based on connected services.

Guiding principles: Company X will establish an internal, IoT-focused, open innovation program in combination with a strategic value chain analysis to identify key opportunities.

3.4 IoT Opportunity Identification and Management

After defining the overall strategy, the concrete opportunities have to be determined. In order to achieve that, the types of opportunities in the context of IoT have to be assessed in the first place. IoT-Ignite differentiates between new business opportunities and internal improvement opportunities [Ente15d, Ente15e].

When it comes to the generation of innovative ideas, there are two different ways mentioned in the methodology: the open idea generation as a green field approach and a structured idea generation with the evolvement of ideas within a given context. The influence of the idea generation method on the creativity of solutions has been researched by Chulvi et al [CGMA13]. According to Ignite it is highly recommended to set up incentive programs in order to encourage employees to involve themselves in the improvement of existing processes as well as the creation of new solutions. Every idea that seems promising requires further refinement to finally evolve into a business opportunity or, later on, a concrete business model.

As there is no common definition on what exactly a business model contains, this study refers to the concept of Gassmann et al. [GaFC13] in which a business model is reduced to four dimensions as depicted in Figure 3. In short: ***Who*** *is the customer*, ***What*** *is the offer*, ***How*** *is the value proposition distributed* and *what is the* ***value*** *for the business?*

The concept is clearly centered on the business model's customer value proposition (CVP) [JoCK08, Oste04, Teec10]. The value proposition is utterly important when examining the suitability of a business model within the Internet of Things as it describes bundles of products and services that are valuable to the customer (e.g. data obtained from connected devices) [Oste04]. For that reason, the systemic frameworks are considered less appropriate as they tend to be too generic and abstract [CaSW14] compared to the value based ones discussed in this term paper.

When the idea refinement has been passed and the opportunity is finally defined, the next step can be performed – the development of an IoT business model. A framework for the development provided in Ignite is the Bosch IoT Business Model Builder. Hereinafter this framework as well as the established St. Gallen Business Model Navigator and the Osterwalder Business Model Canvas will be set against each other.

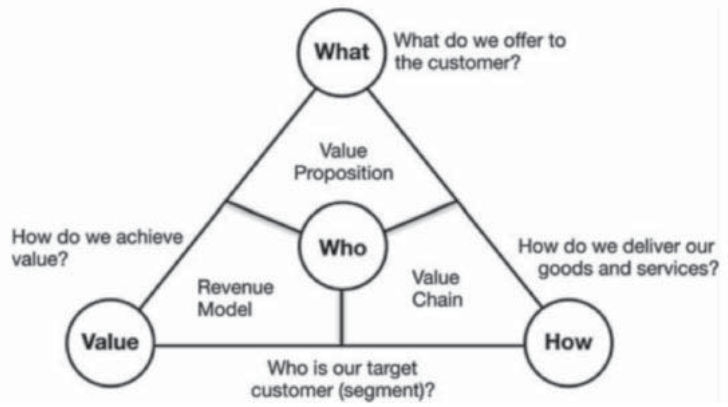

Fig. 2: Customer Value Proposition [GaFC13]

4 Comparison of business model development frameworks

The presentation of the Bosch IoT Business Model Builder in Ignite inevitably raises the question whether already established frameworks could not also fulfill the intended purpose and where the differences and benefits are.

In the following the surveyed frameworks will be introduced and an explanation on the selection will be given.

4.1 Surveyed frameworks

After the scientific appropriateness was ensured, the frameworks mentioned in the examined literature were used for a quantitative analysis in order to determine the most referenced frameworks. The analysis was carried out using the Google Scholar search engine as it performs searches on multiple databases. As a result, the Osterwalder Business Model Canvas and the St. Gallen Business Model Navigator appear to be the most referenced frameworks and therefore are used for the comparison (see Tab. 7).

Bosch IoT Business Model Builder: The Bosch IoT Business Model Builder is a framework for the development of IoT based business models. It especially emphasizes on the peculiarities of the Internet of Things like a clearly articulated partner value proposition (PVP) or the significance of data derived from connected things and the services built on top [Robe15].

St. Gallen Business Model Navigator: The St. Gallen Business Model Navigator is the result of more than five years of extensive research by the University of St. Gallen in which 250 business models from different industries within the last 25 years have been analyzed and 55 recurring business models have been identified [GaFC13]. Based on this knowledge, the developed framework utilizes the power of recombination of these patterns for business model generation [GaFC13].

Osterwalder Business Model Canvas: The Osterwalder Business Model Canvas serves as a tool used to assemble and discuss business models composed of building blocks [OPSM10]. These building blocks cover the four main business areas: customers, offer, infrastructure and financial viability [OPSM10]. According to Osterwalder, Pigneur et al. these building blocks are the best way to properly describe a business model [OPSM10].

4.2 Definition of comparison criteria

The criteria for comparison are derived from the process of business model development as it is explained in the stated literature and complemented with the peculiarities deduced from the Ignite process. The literature that was selected for the definition of criteria represents the most recent and often cited literature in the area of business model development and covers the frameworks that are used for comparison.

The process steps can be concentrated in the three major phases: Initiation, Understanding and Design. Within the initiation phase all steps from the analysis of the current situation over the first idea to the detailed objectives are covered. In the understanding phase the value proposition as well as value-added elements are defined. The last phase of the development process includes the financial perspective as well as the final selection itself. With the conclusion of the final phase, the implementation of the business model is ready to begin, which is covered by the ‘Initiation’ phase of Ignite Strategy Execution.

Phase	Process Step	Criterion	[GaFC13]	[JoCK08]	[OPSM10]	[Robe15]	[TBGF14]
Initiation	Current Business Model Analysis	Situation analysis	X		X		X
		Interaction analysis	X	X	X		
		Risk analysis	X	X	X		X
	Mobilization	Motivation		X	X		
		Involvement of employees from different functions	X	X	X		
		Involvement of industry outsiders	X		X		
		Knowledge allocation		X	X		X
	Ideation	Creative methods (eg. set cards)	X	X	X		
		Recombination of existing concepts and model patterns	X				
		Expert interviews		X	X		X
	Strategic embedding	IoT-Strategy alignment				X	
		Goal definition (short-term/mid-term)			X	X	X
		Differentiator definition		X	X	X	
Understanding	Dimensional analysis (CVP / PVP)	Customer definition (Who)	X	X	X	X	X
		CVP definition (What)	X	X	X	X	X
		CVP distribution (How)	X	X	X	X	X
		Company value definition (Value)	X	X	X		X
		PVP definition	X		X	X	
		PVP distribution	X	X	X	X	
	Value-added analysis	Data from connected things				X	X
		Information				X	
		Services			X	X	
		Technology				X	
		Know-How				X	
Design	Monetary consideration	Cost structure definition	X	X	X		
		Revenue mechanism definition	X		X		X
	Non-monetary consideration	Market entering				X	
		Technology access				X	
	Selection	Prototyping	X		X		X
		Testing			X		X
		Selection	X		X		X

Tab. 4: List of criteria derived from literature

4.3 Framework comparison

The criteria matrix introduced before is now used as the base for the comparison of business model development frameworks. As the matrix represents a comparison and not an evaluation, a rather simple scale is introduced, providing information on how the criteria are covered by the frameworks. '+': covered by framework; '(+)': partially covered by framework and '-': not covered by framework.

Phase	Process Step	Criterion	Bosch	BMC	SGU
Initiation	Current Business Model Analysis	Situation analysis	-	+	+
		Interaction analysis	-	+	+
		Risk analysis	-	+	+
	Mobilization	Motivation	-	+	(+)
		Involvement of employees from different functions	(+)	+	+
		Involvement of industry outsiders	-	+	+
		Knowledge allocation	-	+	(+)
	Ideation	Creative methods (e.g. set cards)	-	+	+
		Recombination of existing concepts and model patterns	-	-	+
		Expert interviews	-	+	(+)
	Strategic embedding	IoT-Strategy alignment	+	(+)	-
		Goal definition (short-term/mid-term)	+	+	-
		Differentiator definition	+	+	(+)
Understanding	Dimensional analysis (CVP / PVP)	Customer definition (Who)	+	+	+
		CVP definition (What)	+	+	+
		CVP distribution (How)	+	+	+
		Company value definition (Value)	-	+	+
		PVP definition	+	+	+
		PVP distribution	+	+	+
	Value-added analysis	Data from connected things	+	-	-
		Information	+	-	-
		Services	+	+	(+)
		Technology	+	-	-
		Know-How	+	(+)	-
Design	Monetary consideration	Cost structure definition	(+)	+	+
		Revenue mechanism definition	-	+	+
	Non-monetary consideration	Market entering	+	-	-
		Technology access	+	-	-
	Selection	Prototyping	-	+	+
		Testing	-	+	-
		Selection	-	+	+

Tab. 5: Comparison of frameworks

5 Conclusion and future work

The comparison of business model development frameworks as the main result of this term paper shows that the Bosch IoT Business Model Builder as it is described in the Ignite methodology should not be considered a stand-alone framework for the development of IoT-specific business models as it lacks significant aspects of the development process, especially in the initiation and design phases. It should rather be regarded as an extension to the established frameworks. When comparing the frameworks, it is apparent that with the combination of the frameworks by Bosch and Osterwalder nearly every criterion is covered. Only the 'recombination of existing concepts and model patterns' is a unique feature of the St. Gallen Business Model Navigator as it more or less describes the core of the framework itself.

From the examination of the Ignite Strategy Execution methodology and the comparison of frameworks several questions emanate that seem worth further research and discussion: a) How can frameworks that are already being used in organizations subsequently be adjusted to support the development of IoT business models?; b) How exactly has an organization's architecture to be changed in order to successfully implement IoT business models?

Appendix

SpringerLink				
Keywords	**Time**	**Attributes**	**Results**	**Selected**
Internet + of + things	2012 - 2015	articles-only / title-only / free-only	72	12
business + model + development	-	title-only / free-only	4	3
business + model + canvas	2012 - 2015	articles-only / discipline-filter / free-only	58	13
idea + generation	-	title-only / free-only	42	7
business + opportunity + identification	2014 - 2015	articles-only / discipline-filter / free-only	177	5

ACM				
Keywords	**Time**	**Attributes**	**Results**	**Selected**
Internet + of + things	2012 - 2015	articles-only / title-only / free-only	131	3
business + model + development	2012 - 2015	articles-only / abstract-only / free-only	156	2

IEEE				
Keywords	**Time**	**Attributes**	**Results**	**Selected**
Internet + of + things	2012 - 2015	articles-only / title-only / free-only	53	5
business + model + development	2012 - 2015	articles-only / title-only / free-only	72	4
business + model + canvas	2012 - 2015	articles-only / title-only / free-only	5	0
idea + generation	2012 - 2015	articles-only / title-only / free-only	66	2
business + opportunity + identification	2012 - 2015	abstracts-only / title-only / free-only	64	5

Tab. 6: Results of literature search

Google Scholar		
Keywords	**Founder**	**References**
Osterwalder Business Model Canvas	Osterwalder	3430
St. Gallen Business Model Navigator	University of St. Gallen	833
Component Business Model	IBM	663
V4 Business Model Framework	Al-Debei & Avison	109

Tab. 7: Quantitative analysis of business model development frameworks

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